

**Bay Area Air Quality Management District**  
939 Ellis Street  
San Francisco, CA 94109

**Proposed Amendments to**

**Regulation 8, Rule 4:  
General Solvent and Surface Coating Operations**

**Regulation 8, Rule 14:  
Surface Coating of Large Appliances and Metal Furniture**

**Regulation 8, Rule 19:  
Surface Coating of Miscellaneous Metal Parts and Products**

**Regulation 8, Rule 31:  
Surface Coating of Plastic Parts and Products**

**Regulation 8, Rule 43:  
Marine Vessel Coating**

**DRAFT**

**Staff Report**

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## **TABLE OF CONTENTS**

<b>1. Executive Summary</b>	<b>1</b>
<b>2. Background</b>	<b>2</b>
<b>3. Regulatory History</b>	<b>3</b>
<b>4. Process Description</b>	<b>5</b>
<b>5. Emissions Subject to Control</b>	<b>7</b>
<b>4. Summary of Regulatory Proposal</b>	<b>10</b>
<b>5. Emission Reductions</b>	<b>11</b>
<b>6. Economic Impacts</b>	<b>13</b>
<b>7. Socioeconomic Impacts</b>	<b>15</b>
<b>8. Incremental Costs</b>	<b>15</b>
<b>9. Environmental Impacts</b>	<b>16</b>
<b>10. Regulatory Impacts</b>	<b>18</b>
<b>11. District Staff Impacts</b>	<b>18</b>
<b>12. Comments and Responses</b>	<b>(not included)</b>
<b>13. Conclusions</b>	<b>19</b>

## EXECUTIVE SUMMARY

The 2001 San Francisco Bay Area Ozone Attainment Plan calls for the reduction of volatile organic compounds (VOC's) to enable the Bay Area to attain the 1-hour national ozone standard. Various surface coating rules in Regulation 8: Organic Compounds, limit the VOC content allowed in various types of coatings. Different surface coating rules are targeted at specific industries, based on an assessment of the technologies that can be implemented to reduce VOC's for each type of industry. The Ozone Plan contains various control measures for stationary and area sources based on emission reduction opportunities identified during the plan development. Included among them is control measure SS-13, Surface Preparation and Cleanup Standards for Metal Parts Coating. SS-13 identified two rules in Regulation 8, Rule 14: Surface Coating of Metal Furniture and Large Appliances, and Rule 19: Surface Coating of Miscellaneous Metal Parts and Products, for additional emission reductions based on the use of low VOC content surface preparation solvents and cleanup solvents. The Ozone Plan projects emission reductions of 0.3 tons/day from an inventory of 0.5 tons/day at a cost effectiveness of \$1,100 per ton VOC reduced.

This proposal expands on the control measure presented in the Ozone Plan. An investigation into the emission inventory has led staff to conclude that the inventory of emissions from surface preparation and cleanup solvent use that might be controlled from this proposal are 3.75 tons/day, significantly higher than the original estimate of 0.5 tons/day. These additional emissions are part of the inventory, but listed under a separate category of unspecified wipe cleaning (handwiping) emissions that was not considered when this control measure was drafted. This proposal includes amendments to five surface coating rules. In addition to Rules 14 and 19, staff propose to regulate solvents used in surface preparation and clean up in Rule 4: General Solvent and Surface Coating Operations; Rule 31: Surface Coating of Plastic Parts and Products; and Rule 43: Marine Vessel Coating. The emission reductions from the amendments to these five rules are expected to be 2.19 tons/day.

The proposal sets a VOC standard for surface preparation and cleaning solvents of 50 grams per liter. This is between 5 and 7 percent, by weight, of solution. Some organic compounds are exempt, because they have a negligible contribution to photochemical reactivity. In District surface coating rules, as per the Board's 1993 Stratospheric Ozone Policy, only compounds that do not contribute to stratospheric ozone depletion and are not toxic are exempt from being considered as VOC. Staff have identified numerous cleaning solutions, both aqueous and exempt solvent based, that are currently available to meet the proposed standards.

Any potential detrimental environmental impacts are expected to be insignificant. An environmental impact analysis will be prepared, in association with either a Negative Declaration or Environmental Impact Report, pursuant to the provisions of the California

Environmental Quality Act. The amendments are very cost-effective, with costs between \$165 and \$198 per ton VOC reduced. This is because many replacement solvents are less expensive, when diluted for use, than the organic solvents they replace. A socioeconomic analysis will be prepared to accompany the final staff report, in accordance with the provisions of the California Health and Safety Code, Section 40728.5.

The proposed amendments have been discussed with a Bay Area industry trade association and a public workshop is scheduled for June 20, 2002. In addition, staff expect to work with a major coating manufacturer to evaluate coating results after use of a low-VOC cleaning solvent. Results should be available before the public hearing. These amendments are based on rules already implemented in the South Coast AQMD and adopted in the San Joaquin Valley AQMD. Also, a public hearing on a similar proposal is scheduled for May 23, 2002 in the Sacramento Metropolitan Air Quality Management District.

## **BACKGROUND**

District surface coating rules impose volatile organic compound (VOC) limits on paints and coatings applied to substrates or items specific to each rule. Rules are typically broken out by industry type where needs for specific coatings can be identified. Examples in Regulation 8 are Rule 11: Metal Container, Closure and Coil Coating; Rule 29: Aerospace Assembly and Component Coating Operations; and Rule 45: Motor Vehicle and Mobile Equipment Coating Operations. These rules regulate very specific operations. Other rules regulate a broader scope of industries, such as Rule 19: Surface Coating of Miscellaneous Metal Parts and Products and Rule 31: Surface Coating of Plastic Parts and Products. Each rule contains specific allowable VOC content limits and spray application equipment limitations, also designed to further reduce emissions. Rules typically require use of covered containers to minimize solvent evaporation from storage, wipe cleaning, and clean up. However, in only a few cases are the solvents used for clean-up or surface preparation regulated. This proposal is intended to provide VOC limits on solvents used for surface preparation on metal parts and related industries, plastic parts, marine vessels and parts, metal appliances and furniture, and general surface coating applications.

The Bay Area District is designated as a nonattainment area for the federal one-hour ozone standard. Ozone, a criteria pollutant, is formed from a reaction of volatile organic compounds and oxides of nitrogen in the presence of ultraviolet light (sunlight). The EPA has set primary national ambient air quality standards (NAAQS) for ozone and other air pollutants to define the levels considered safe for human health. The District is designated as an unclassified nonattainment area for the one-hour ozone standard. The Bay Area 2001 Ozone Plan is a formal strategy to reduce ozone precursor emissions in order to attain the national standard. The Plan was adopted at the joint meeting of the co-

lead agencies, BAAQMD, MTC, and ABAG, on October 24, 2001 and was approved by the CARB on November 1, 2001. The Plan contains new transportation, mobile source and stationary source control measures. Among the stationary source control measures is a commitment to adopt VOC standards for surface preparation and clean-up solvents in District Regulation 8, Rule 14: Surface Coating of Large Appliances and Metal Furniture and Rule 19: Surface Coating of Miscellaneous Metal Parts and Products.

The Bay Area District is also designated as a non-attainment area for the California one hour ozone standard. The California Air Resources Board set the ozone standard at a level of 9 parts per hundred million (pphm) for a one-hour average, significantly more stringent than the national standard of 12 pphm. Under the requirements of the California Clean Air Act of 1988, areas not complying with the standard must prepare plans to reduce ozone. Plans were required in 1991 and each three years thereafter. The most recent District Clean Air Plan to meet this requirement was prepared in 2000 and adopted by the District Board of Directors on December 20, 2000.<sup>1</sup> This proposal will fulfill the requirements of Control Measure #A-5 in that Clean Air Plan.

## **REGULATORY HISTORY**

Five surface coating rules are included as part of this proposal. Typical of District rules, these are technology-based standards directed toward specific industries, but applicable to a specific type of operation, regardless of the main industry of the facility operator. For example, coating of a miscellaneous metal part would be subject to the miscellaneous metal parts rule, whether the part were coated in a petroleum refinery, aircraft maintenance center or contract painting shop. The rules are all part of Regulation 8, which addresses emissions of organic compounds. The five rules are:

- Rule 4: General Solvent and Surface Coating Operations;
- Rule 14: Surface Coating of Large Appliances and Metal Furniture;
- Rule 19: Surface Coating of Miscellaneous Metal Parts and Products;
- Rule 31: Surface Coating of Plastic Parts and Products; and
- Rule 43: Marine Coating Operations.

Each rule is similar in that it contains volatile organic compound (VOC) content limits for various coatings based on a description of the type of coating or substrate. Application technology is dictated based on expected maximization of liquid coating transfer efficiency consistent with finished product appearance needs. Administrative requirements include records for coatings applied and solvents used on a daily, weekly or monthly basis. The VOC content limits of the rules do not limit total facility emissions. These are typically limited by permit conditions or by the District's New Source Review rule, which requires a permit review and the use of Best Available Control Technology (BACT) for emission increases of 10 pounds per day. Permits are required for any

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<sup>1</sup> Bay Area 2000 Clean Air Plan and Triennial Assessment, December 2000, BAAQMD

source at a facility which uses 30 gallons per year of coating, 20 gallons per year of solvent, or emits 150 pounds per year of VOC emissions.

The original intent of Rule 4, adopted in 1974, was to control sources of solvent evaporation and surface coating by limiting the amount of more reactive organic compounds that could be emitted. Based on the Los Angeles Air Pollution Control District Rule 66, Bay Area Air Pollution Control District Regulation 3, later recodified as Regulation 8, limited emissions from source operations to 3000 lbs per day, and 450 lbs per hour provided the VOC emitted complied with the following definition: no more than 5% aldehydes and olefins; no more than 8% aromatic compounds; no more than 20% ethylbenzene, ketones with branched structures, trichloroethylene, or toluene; and no more than 20% of the three classes in combination. For emissions that were not “compliant” according to this definition, the emission limit was 40 lbs per day, unless reduced 85% through an air pollution control device. In the absence of other surface coating rules, Rule 4 applies to any solvent or surface coating operation. However, with the adoption, over time, of other rules for specific applications, Rule 4 has applied to fewer and fewer sources. After the rule was recodified as Regulation 8, Rule 4 in 1980, it was amended in 1982 and 1994. In 1996 a number of issues in the rule were addressed, including implementation of the Board’s Stratospheric Ozone Policy, and clarification of specific source operations that were subject to the standards in the rule. At that time, emission limitations were changed to allow either: 1) no more than 5 tons organic compound emissions per year (an annualized 40 lb per day standard); 2) an 85% reduction in emissions; or, 3) the use of a surface coating that contains no more than 420 grams VOC per liter (3.5 lbs per gallon).

Rule 14, applicable to the surface coating of large appliances and metal furniture, was derived from two EPA Control Technology Guidelines (CTG’s), one for coating of metal furniture<sup>2</sup> and the other for coating of large appliances.<sup>3</sup> Rule 14, adopted by the District Board on March 7, 1979, was amended in 1982, 1984, 1987, 1989, 1993 and 1994. The 1982 and 1984 amendments adjusted the VOC limits and compliance dates in the rule, the 1987 and 1989 amendments further reduced emissions, and the 1993 and 1994 amendments were to address EPA policy issues. This exemplifies the progress of District surface coating rules since inception. There were initial difficulties in achieving compliance in the early 1980’s, followed by a period of technical innovation and acceptance of low-VOC paint technology, and consequently, significant emission reductions in the middle and late 1980’s. Finally, in 1989 and the early 1990’s, rule development activity was based on post-1988 State Implementation Plan (SIP) call EPA policy revisions and implementation of transfer efficiency standards, rather than wholesale changes in VOC limits.

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<sup>2</sup> EPA-450/2-77-032; US EPA; 1977

<sup>3</sup> EPA-450/2-77-034; US EPA; 1977

Rule 19, for miscellaneous metal parts, was adopted on January 9, 1980 and based on the EPA CTG, "Control of Volatile Organic Compounds from the Surface Coating of Metal Parts."<sup>4</sup> The metal parts rule was particularly important in the Bay Area because it was the source of a large quantity of emissions associated with manufacturing of computer housing and military specification equipment. The rule was amended numerous times: in 1981, 1984, 1985, and twice in 1987 to revise VOC limits and exemptions; again twice in June 1989 as a response to the EPA policy issues; in 1993 to mandate transfer efficient application methods; and in 1994 to again align the rule with EPA policies.

Rule 31: Surface Coating of Plastic Parts and Products, was adopted on September 7, 1983, control emissions from the developing computer industry in the Bay Area, and was modeled after Rule 19. A significant computer service industry had grown up around the San Francisco/San Jose Silicon Valley area. Painting job shops would coat, but not manufacture, metal or plastic computer boxes, in addition to metal parts for aircraft and military applications. Rule 31 was amended concurrently with, and for the same purposes as, the metal parts rule: twice in 1987, in 1989, 1993 and 1994.

Rule 43, for surface coating of ships, barges, submarines, offshore oil platforms and other items subject to a marine environment, was adopted on November 23, 1988. Rule 43 was amended in 1993 and 1994 to satisfy EPA policy concerns, and again in 2001 to provide for a narrow exemption that ended a multi-year variance for surface coating of a historic, docked wooden ship that serves as a museum. Rule 43 was also the model for the EPA's 1994 Alternative Control Techniques Document: Surface Coating Operations at Shipbuilding and Ship Repair Facilities,<sup>5</sup> and subsequent CTG.

## PROCESS DESCRIPTION

Paint application requires a very clean, neutral surface, especially for the application of low VOC two component and 100% solids powder coatings. Dust, traces of water, particles with an ionic charge, or even fingerprints will create an area where a coating cannot adhere properly or creates some visible mark that shows through the surface of the coating film. Painters use a variety of techniques to prepare the surface for coating. Parts may be sandblasted, followed by a rinse and dry cycle; pressure washed with steam to remove any soils, oils or greases; or treated with a series of dip tanks to remove soils and rinse the surface. Any rinse must be thoroughly dried to prevent flash rusting of ferrous parts. Metal or plastic might be wiped with solvent. Solvents used for wipe cleaning include acetone, due to the relatively low cost and VOC-exempt status; d-limonene, derived from citrus, or mineral spirits, both due to the low evaporation rate; or paint thinner or reducer, due to availability and assured compatibility with subsequent coatings.

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<sup>4</sup> EPA-450/2-78-015, US EPA, 1978

<sup>5</sup> EPA-453/R-94-032; US EPA; April, 1994

Solvents clean by interacting with soils in such a way as to lift them from a surface. This occurs when the soil has more affinity for the solvent than it does for the surface. Inorganic soils tend to be hydrophilic, meaning water-loving, and they dissolve effectively in water and other polar solvents such as alcohols. Organic soils, such as greases, waxes and oils, are considered hydrophobic, meaning water-hating. They tend to dissolve more effectively in non-polar organic solvents like mineral spirits. Other considerations in any type of cleaning include the substrate, cleanliness requirements, drying requirements and environmental constraints.<sup>6</sup>

Low VOC surface preparation products generally fall into one of several classes. There are aqueous solutions, where an organic solvent is diluted in water, aqueous solutions where there is no VOC, and exempt solvent solutions. Aqueous solutions may be alkaline (high pH, 8 to 14), acidic (low pH, 0 to 6) or neutral (pH near 7). Organic compounds such as esters, terpenes, and alcohols tend to be water soluble and may be used to produce water based cleaning compounds that have many of the cleaning attributes of organic solvents. Acidic solutions tend to be most useful for removing contaminants like scale or mineral salts. They are usually not the best choice for cleaning greases and oils, which are more typical of contaminants that must be cleaned in preparation for surface coating. Neutral solutions generally contain surfactants and may contain corrosion inhibitors or dispersants, which help prevent soils from re-depositing on the surface. Alkaline solutions also contain surfactants, which serve to reduce the surface tension of soils, allowing water to loosen and dissolve them. Alkaline solutions, too, can contain corrosion inhibitors. Organic solvents that are water soluble serve to reduce surface tension. Very high pH solutions are caustic, and would remove carbonaceous soils. However, caustic solutions could be corrosive on plastic surfaces. More mildly alkaline solutions, with a pH in the 8 to 11 range, are abundant and suitable for the oil and grease – the type of soils typically encountered in surface coating. Alkaline solutions are usually rinsed; however any solution, regardless of pH, may require rinsing. Rinsing of a part in preparation for surface coating is an important step to obtain a residue-free surface for coating. Even organic solvents might require rinsing if they have a low evaporation rate, and therefore would tend to leave a residue. Many coating operations have ovens. Most shops do not bake coatings at high temperatures, however, ovens are used to dry parts in preparation for painting and to force two component coatings to cure. These ovens are often used to dry rinsed parts.

Wipe cleaning is the wetting of a cloth with a cleaning solution accompanied by a physical rubbing process. Although this may seem obvious, aqueous cleaning, to be effective, depends on a certain amount of agitation. The rubbing process serves to expedite solvent contact and lift the soil off the surface. The success depends on the ability of a cleaning solution to dislodge or dissolve the soil so that it can be easily picked up by a cloth in a short amount of time. Conventional organic solvent wipe cleaning is

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<sup>6</sup> Kanegsberg, Barbara, Overview of Cleaning Agents, Handbook for Critical Cleaning, CRC Press, 2001

mostly done with acetone, isopropyl alcohol, d-limonene, or paint thinner. Each of these organic solvents has advantages and disadvantages. Acetone is exempt from consideration as a VOC, so would be allowed under the proposed amendments. It may be currently used to limit precursor organic emissions due to permit conditions, or, because it is in the ketone family of organic compounds (carbonyl group attached to two carbon atoms). Ketones are typically found in solvents in paints, and solvents in the same family are generally compatible, so acetone would tend not to interfere with paint film formation if some small amount of residual solvent were to remain on the part. Acetone is also an effective, quick solvent for oils and greases. Acetone, however, also evaporates very quickly, is highly flammable, and odorous. Other attributes that might create harmful effects are more fully discussed in the environmental impact analysis that will accompany this report.

Isopropyl alcohol, or isopropanol, is not exempt from consideration as VOC. It is particularly good at cleaning fingerprints, is also moderately good at cleaning oils and greases and does not evaporate as quickly as acetone. It also has a distinct odor and is flammable. Quick and thorough evaporation is important to minimize the possibility of residue and minimize turn-around time. It is also miscible in water, so can be rinsed and dried to produce a residue free surface.

d-Limonene, or 1-methyl-4-(1-methylethenyl) cyclohexene, is derived from citrus. It has a pleasant odor and is not drying to the skin like acetone or isopropyl alcohol. It has a very low evaporation rate. This makes it good for cleaning items that require soaking, but less effective for wipe cleaning as any residue would be slow to evaporate. It has good solvency characteristics but is not an exempt solvent. Although it is not miscible in water, a solution can be made by mixing it with a surfactant, so it can be used to create low VOC aqueous cleaning solutions that evaporate much more quickly than pure d-limonene. There are many household cleaning products based on this technology.

Thinner, or reducer supplied by a paint company has the advantage of being most likely compatible with a coating subsequently applied. Also, ordering is simplified because it can be combined with paint orders. A blend of solvents that vary with manufacturer, thinners could be expected to be somewhat more expensive than individual solvents. This may be outweighed by the ease of ordering.

### **EMISSIONS SUBJECT TO CONTROL**

In the 2001 Ozone Plan, Control Measure SS-13 shows 0.5 tons per day as the year 2000 VOC emissions for the surface preparation and clean-up portion of the combined source categories of Miscellaneous Metal Parts and Products and Large Appliance and Metal Furniture. Of this 0.5 tons, the control measure was anticipated to result in a 0.3 ton/day reduction. Recent inventory updates put the total clean-up and surface preparation for miscellaneous metal parts at 0.33 ton per day, for metal furniture and large appliances at

0.11 tons/day, for plastic parts at 0.24 ton per day and for marine vessel coating at 0.07 ton per day. The total of these four source categories is 0.75 tons per day.

The emission inventory is developed from annual reports submitted by permitted facilities. In addition to permitted operations, termed “point sources” by District engineers, emissions inventories for each source category include some amount of emissions attributable to sources too small to require permits, termed “area sources”. The total emission inventory can then be determined for each source category, and estimated reductions based on control measures are used by atmospheric modelers to calculate emission reductions necessary to improve air quality and to progress toward meeting standards. However, some inventory categories utilize information from other sources. In 1996 the CARB issued a report by Pechan and Associates titled, “Solvent Cleaning/Degreasing Source Category Emission Inventory”<sup>7</sup>. This report, referred to as the Pechan Report, created a statewide emission inventory of solvent cleaning which includes solvent emissions from vapor degreasers, cold cleaners and wipe cleaning. The report utilized surveys and manufacturing and employment data to create the inventory, and it is used as the basis for statewide modeling efforts and the California State Implementation Plan. The report does not break down handwiping emissions into the source categories that the Bay Area inventory does. So, District engineers attribute emissions to separate source categories associated with various operations, including additional categories to those mentioned above, such as graphic arts printing, architectural coating and semiconductor manufacturing. Then, they subtract the total source category emissions generated by the bottom-up approach from the Bay Area portion of the statewide handwiping inventory generated by the top-down approach. The difference creates a category of general handwiping emissions, that are not associated with any other specific source categories. It amounts to 4.71 tons reactive organic compounds per day. This created the question, “In what industries and in what applications is handwiping being done, but not recognized as part of the source categories in the emission inventory?”

Staff suspect that the answer to this question is that there are numerous shops that utilize wipe cleaning operations that are not under permit, either because they do not use enough solvent to need permits, or, more likely, because the nature of their business is such that they do not need permits for any other operations, so are unaware of the permit requirements for wipe cleaning. The use of organic solvent for wipe cleaning requires a permit if the operation uses more than 20 gallons per year or results in 150 lbs emissions per year, which is roughly 20 gallons of a typical solvent. Monique Davis, Engineer at CARB, was able to draw information from the original database used for the Pechan Report on types of businesses and Standard Industrial Classification Codes (SIC Codes) that use solvent for cleaning. A number of types of manufacturers were identified that may use solvent for cleaning that might not otherwise require permits, primarily because

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<sup>7</sup> Solvent Cleaning/Degreasing Source Category Emission Inventory, Final Report 93-341, E.H. Pechan and Associates, Inc., August, 1996

they might not do any surface coating. The types of products manufactured which typically might not be surface coated, followed by their SIC Codes are: hand and edge tools (3423); hardware (3429); fabricated plate work (boiler shops) (3443); screw machine products (3451); bolts, nuts, screws, rivets and washers (3452); iron and steel forging (3469); electroplating, plating, polishing, anodizing and coloring (3471); industrial valves; fluid power valves and hose fittings (3492); fabricated pipe and pipe fittings (3498); steam, gas and hydraulic turbines, and turbine generator set units (3511); special tools and dies, die sets, jigs and fixtures and industrial molds (3544); cutting tools, machine tools and accessories and machinists' precision measuring devices (3545); industrial and commercial fans and blowers and air purification equipment (3564); air conditioning and warm air heating equipment and commercial and industrial refrigeration equipment (3585); motors and generators (3621); and fasteners, buttons, needles and pins (3965).

It should be noted that the emission inventory for handwiping solvents, as iterated above, is 4.71 tons per day of *reactive* organic compounds. The Pechan Report was published in 1996 and based on 1993 data. The projected emissions of total organic compounds for the year 2000 is 9.95 tons per day. Over 50% of the emissions are non-reactive. However, the relative percentage of reactive (or precursor) to non-reactive (or non-precursor) emissions used today must be questioned for several reasons. First, the Montreal Protocol and 1990 Clean Air Act Amendments require a phase-out of production of chlorinated solvents because they deplete the protective ozone shield surrounding the earth's atmosphere. The production of 1,1,1 trichloroethane (TCA), at one time the cleaning agent of choice, was completely halted effective January 1, 2002. In the interim, production reductions and excise taxes on the material quickly made TCA lose favor for use as a wipe cleaning solvent, although it still exists in critical cleaning uses in vapor degreasers, where losses to the atmosphere are controlled to a great extent. Second, in the period since the Pechan Report, several solvents were exempted by EPA from VOC control. Among these is acetone, in 1995 declared by EPA to have a negligible contribution to photochemical reactivity.<sup>8</sup> Acetone is an effective solvent on a variety of greases and soils. It is also relatively inexpensive, so the use of acetone has probably increased since the EPA exemption. This has been borne out by anecdotal information. The extent to which these two factors interact can only be guessed at. Staff estimate that the relative percentage of reactive organic compounds in solvents used for wipe cleaning has increased. This is because District surface coating rules do not restrict the use of solvent in wipe cleaning applications, although a significant increase at any one facility could trigger new source review provisions.

Also, staff believe that the total emissions from handwiping solvents have decreased. Due to pressures to reduce solvent usage in shops to reduce emissions, lessen fire and safety hazards, and protect workers health, this type of solvent usage has been reduced in

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<sup>8</sup> 60 FR 31633

the near decade since the Pechan Report data. In that time, various aqueous cleaning compounds and low volatility formulations like citrus based cleaners (d-limonene) have become much more readily available and accepted. The net result, taking into effect these considerations, is a judgment call until such time as a more comprehensive emission survey can be undertaken. However, staff believe that the total emissions inventory for the unspecified category of handwiping emissions is no more than 5 tons per day, and that the reactive organic compound emissions portion of that category amounts to 3 tons per day.

### **SUMMARY OF REGULATORY PROPOSAL**

The rules for which low VOC surface preparation standards are proposed are already similar. Each contains VOC limits for coatings and solvent evaporation minimization standards that apply house-keeping standards to paint and solvent usage. For example, all rules already require that containers of paint or solvent be covered, solvent laden rags not be air dried, and solvent used for clean up of spray equipment be collected and stored in covered containers. Each also contains record keeping requirements, various exemptions and spray gun equipment standards.

Rule 16: Solvent Cleaning Operations specifically addresses cleaning done in containers, vats, parts cleaners or vapor degreasers where parts can soak in a pool of cleaning solution. Each of the surface coating rules will contain the VOC standards for both coatings and solvents specific to the substrate coated. Facility operators that routinely surface coat one type of substrate or item can find requirements that they need to adhere to in one place, rather than in several separate rules.

The proposed changes are:

- Titles have been modified to clarify that the rule applies to surface preparation as well as coating of the applicable substrate.
- The description of each rule has been expanded to include control of volatile organic compounds used in surface preparation and clean up of applicable substrates.
- A specific exemption for solvents that do not contain VOC and for operations subject to and in compliance with Rule 16: Solvent Cleaning Operations.
- Some clarifying language has been added for aerosol coatings, as there are now VOC standards for aerosol coatings in the California Code of Regulations.
- A definition of surface preparation has been added.
- The Volatile Organic Compound content definition has been modified to state that the VOC content of solvents is determined by subtracting the weight of water and any exempt solvents from the weight of VOC; but, unlike coatings, the volume of VOC is not subtracted from the total solvent volume.
- A standard of 50 grams per liter (0.42 lbs per gallon) VOC has been added for surface preparation solvents.

- A standard of 50 grams per liter (0.42 lbs per gallon) VOC has been added for clean up solvent, except where solvent can be pressurized through spray equipment without the use of atomizing air and collected and stored in closed containers for recycling or offsite disposal.
- The record keeping section of each rule has been modified to require monthly records of solvents used for surface preparation and clean up.
- A reference to the District test method to evaluate VOC content of solvents has been added.

In Rule 4: General Solvent and Surface Coating Operations, an exemption from the standards for the surface preparation of electrical components and medical devices is proposed. Electrical components are mainly printed circuit boards. Most cleaning of PC boards is done with water or aqueous solutions. Some small amount of solvent cleaning is necessary to remove maskant or adhesive for the hand installation of components. This is done using very small amounts of solvent, usually isopropyl alcohol and sometimes acetone, often using Q-tips. Medical devices are required to be cleaned with isopropyl alcohol. This standard is not necessary in the other surface coating rules. If medical devices were painted, the mandate to use isopropyl alcohol does not apply.

These changes accomplish the objectives of Control Measure SS-13 in the 2001 Ozone Attainment Plan, provide for some clarifications to existing language and implement the mandates concerning stratospheric ozone depleting and toxic compounds in District's Stratospheric Ozone Plan.

## EMISSION REDUCTIONS

Control Measure SS-13 in the 2001 San Francisco Bay Area Ozone Attainment Plan estimates a reduction of 0.3 ton VOC per day from a 0.5 ton per day inventory for the categories of miscellaneous metal parts and products and large appliances and metal furniture. This is a 60% reduction. The refined inventory since that time for the year 2000 estimates a 0.44 ton per day inventory for these two categories plus a 0.24 ton per day inventory for plastic parts and products and 0.07 ton per day inventory for marine vessel coating. These four categories total 0.75 ton per day. The emission reduction estimate for these categories is approximately 70%, equaling emission reductions of 0.56 ton per day. In addition, staff estimates an additional 3 ton per day inventory from the unspecified handwiping category, as explained above. These emissions are those subject to Regulation 8, Rule 4: General Solvent and Surface Coating Operations.

The total emission reduction is calculated as follows:

Emission Reduction = Emission Inventory \* % Subject to Control \* % Control

Emission Inventory, surface preparation and clean up solvent:

Metal Parts and Products	0.33 * 75% * 93%
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Large Appliances and Metal Furniture	$0.11 * 75\% * 93\%$
Plastic Parts and Products	$0.24 * 75\% * 93\%$
Marine Vessels	$0.07 * 75\% * 93\%$
	$0.75 * 75\% * 93\% = 0.52 \text{ tons per day}$
General Solvent and Coating	$3.00 * 60\% * 93\% = 1.67 \text{ tons per day}$
	$= 2.19 \text{ tons per day}$

The 75% Subject to Control Factor is derived from an estimate of the amount of organic solvent emissions in the facility that is listed in the emission inventory as surface preparation and clean up emissions that would be subject to the proposed standards. The remaining 25% includes emissions from cleaning pressure pot spray equipment, where low VOC formulations using non-compatible solvent could cause residual paint in paint lines and spray equipment to curdle or set. Most surface coating equipment in these industries are of this type. The remaining spray gun types, called cup guns or gravity guns, can be fully disassembled and cleaned. Cleaning done in solvent parts cleaners or spray gun cleaners is subject to the standards in Rule 16. Nevertheless, there will probably be some small increase in cleaning of cup guns in solvent cleaners as a result of the proposed amendments. This is considered as part of the 25%. Also, some loss of solvent to the atmosphere is estimated from recycling and evaporating systems. An additional loss is assumed from solvent evaporation due to open cleaning solutions during mixing of concentrate. For facilities subject to Rule 4, electrical and medical devices are exempt from the surface preparation standards. This is the rationale for the 60% factor used for emissions subject to control for Rule 4 instead of 75%. Emissions from facilities that are already using low VOC solvents for surface preparation and cleaning activities are not part of the Subject to Control factor, because this reduction has already been taken into account in the inventory based on annual facility reports.

The 93% Control Factor is derived from the proposed VOC standard, 50 grams per liter. A change from the use of isopropyl alcohol (785 g/l) to a 50 g/l solvent is a 93% reduction. The other major organic solvent used, paint thinner/reducer has a VOC content that varies with manufacturer, however, it would likely be comparable to isopropyl alcohol. Staff believe the assumptions used to project emission reductions are conservative. There may be a percentage of emissions greater than 60% and 75% that are controlled through this proposal. Also, the inventory may be different from the estimate, however, a change would affect both the inventory and reduction estimate. Staff believe that the inventory of unspecified handwiping emissions was over-estimated, as discussed above in "Emissions Subject to Control." If the high estimates are correct, then reductions would also be larger than shown here. If the baseline emissions are less than we project, then the inventory should be lowered by a greater amount.

## ECONOMIC IMPACTS

Aqueous solutions are more expensive than conventional organic solvents. However, they are sold in concentrated form and, when dilute for use, can actually save money. The following are typical representative prices of conventional organic solvents used for wipe cleaning. The prices are based on a 5 gallon container size:

Isopropyl Alcohol, \$10.00/gal

Methyl Ethyl Ketone, \$13.00/gal

d-Limonene, \$16.00/gal.

Thinner/reducer, \$10.00/gal

Average, \$12.25/gal.

Replacement cleaning solutions are typically sold in concentrated form and diluted with water for use. Dilution ratios range from 1% solution in water to 40% solution in water. The following lists representative prices from a variety of vendors for their product, as sold in 5 gallon or greater size. All products examined fell within these prices and dilution ratios.

Table 1

Product	Price per gallon	Dilution ratio	Price/gal as used
Acetone	\$ 9.00	None, exempt VOC	\$9.00
Methyl acetate	\$16.00	None, exempt VOC	\$16.00
Aqueous organic #1	\$14.55	5%	\$0.72
Aqueous alkaline #2	\$11.54	20%	\$2.31
Aqueous alkaline #3	\$10.00	2%	\$0.20
Aqueous neutral #4	\$ 6.80	33%	\$2.27
Aqueous acidic #5	\$10.00	33%	\$3.33
Aqueous neutral #6	\$30.00	5%	\$1.50
VOC-exempt blend #7	\$18.00	None	\$18.00
Aqueous organic #8	\$29.67	40%	\$11.87
Aqueous organic #9	\$12.00	20%	\$2.40
Aqueous alkaline #10	\$38.00	5%	\$1.90

The average of the table for replacement cleaning solvents is \$5.79 per gallon as used. The median price for replacements is between \$2.31 and \$2.40 per gallon. In both cases these represent a cost savings over the use of organic solvent. Even if acetone were selected, as an exempt replacement, the cost would be slightly less than the most often used organic wipe cleaning solvents, isopropyl alcohol and thinner/reducer. Acetone is commonly used now for this purpose.

Organic solvents that are not evaporated must be disposed of as hazardous waste. Likewise, water based cleaning solutions that are sufficiently contaminated with greases, oils, rust, scale or fine metal particles will have to be disposed of as hazardous waste. Surface coating operations already have to deal with hazardous waste disposal. Solvents contaminated with soils may be recycled or distilled for re-use, but the sludge must be

disposed of as hazardous waste. Aqueous systems, whether hand wiping, high pressure or steam washing, or dip tank treatment must also have contaminants removed before discharge. Water pollution control requires stringent standards be met for pH, metals and a host of other contaminants before they can be discharged. Some facilities have evaporation or distillation systems, and no longer have the need for discharge permits. The remaining sludge from an aqueous system must be disposed of as hazardous waste, however, typically, this can be commingled with waste from a solvent still.

For the purposes of the cost estimates, staff assume that one third of the facilities will purchase a distillation or evaporative unit to comply with the proposed amendments. Another third would comply by the use of exempt organic compounds that would be handled in the same way that existing, non-exempt organic solvents are handled, incurring no new equipment costs. The remaining third would already have distillation or evaporative units and would also incur no new equipment costs. Probably, the large majority of existing metal and plastic coaters will be in this third class, however, many of the solvent users in the unspecified handwiping category would be in the first class. The District's databank lists 308 permitted facilities subject to the four specific surface coating rules and an additional 332 permitted facilities in the unspecified handwiping category. These do not represent all the source operations that are subject to the rules, but represent the Standard Industrial Classification Code that most accurately describes a facility's principal business. For example, refineries may do some coating subject to the standards in the Miscellaneous Metal Parts and Products rule, but would not be included in the count of permitted facilities.

The equipment cost for an evaporator, to process aqueous solvent, is about \$3000. Equipment costs for the Bay Area would be as follows:

$$640 * 0.33 * \$3000 = \$640,000$$

Based on the emission inventory, 3.75 tons/day at 785 grams/liter VOC content = 1146.5 gallons organic solvent/day. Assume solvent gallonage remains constant.

Total cost (\$640,000) annualized over a 10 year period, at 10% interest = \$1,014,917.

Assuming a 250 day work year, equipment costs, per day = \$406.

No consideration is given for equipment depreciation, or hazardous waste disposal costs, which could decrease with the use of aqueous solvents with an evaporator.

This table presents a range of costs, including highest cost, replacement solvent, average cost and median cost, including equipment costs, above. Because some facilities will incur costs from purchase of solvent distillation units or evaporators, and others will not, data are presented as totals per day.

Table 2: Cost Effectiveness

	Highest Cost	Average Cost	Median Cost
Equipment Cost/day	\$406	\$406	\$406
Replacement Solvent Cost/day	\$83	\$27	\$11
Total Cost/day	\$489	\$433	\$417
Organic Solvent Cost/day	\$56	\$56	\$56
Cost difference/day	\$433	\$377	\$361
Cost/ton emission reduced (2.19 ton)	\$198/ton	\$172/ton	\$165/ton

### SOCIOECONOMIC IMPACTS

Subdivision (a) of the Health and Safety Code, Section 40728.5 states, “Whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available, perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation.” A socioeconomic impact analysis will be prepared by Applied Development Economics, of Berkeley, California. Affected business will include metal and plastic parts fabricators in a variety of SIC codes, whether they paint their products or not.

### INCREMENTAL COSTS

Health and Safety Code, Section 40920.6 requires the District to (1) identify one or more control options which achieves the emission reduction objectives for the proposed revision, (2) review the information developed to assess the cost effectiveness of the potential control option, and (3) calculate the incremental cost effectiveness for the potential control options. To determine incremental cost effectiveness, the District must “calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.” Where only one control option is identified, no incremental cost analysis need be performed.

Based on comments received at the workshop, increments may be developed, however, there has been only one control option developed at this point, the replacement of organic solvents used for wipe cleaning with solvents that can meet an aqueous standard of 50 g/l. As only one control option identified at this point, the analysis is not required.

## ENVIRONMENTAL IMPACTS

The District is required to adhere to the requirements of the California Environmental Quality Act in adoption of District rules. Although it is expected that adoption of the proposed amendments will create a net positive environmental benefit from a reduction in emissions of volatile organic compounds, and reduce potential exposure of workers to some hazardous solvents, staff will examine and evaluate any potential adverse impacts of the proposed amendments. Potential adverse impacts may include: 1) the proposed exemption for methyl acetate, 2) an increase in exposure to hazardous or toxic solvents due to replacements used in low-VOC formulations, 3) the potential fire hazard from the use of acetone as a replacement, and 4) the potential for the amendments to create a water quality impact should water-based cleaning solutions be disposed of into sewer systems.

On April 1, 1998, the US EPA exempted methyl acetate from control based on a determination that methyl acetate had a negligible effect on atmospheric photochemical reactions.<sup>9</sup> Methyl acetate is a low boiling point ester solvent that rapidly evaporates. It may be useful as a substitute coating solvent because it is soluble in water, alcohol, acetone and a variety of other solvents. It is not an ozone depleting chemical and has not been found to be toxic by the US EPA or state of California. It is flammable and has a fruity odor characteristic of esters. The odor threshold, that concentration at which the chemical can be detected, is 4.6 parts per million, just slightly lower than methyl ethyl ketone, a commonly used coating solvent. It is not considered to be a significant contributor to global warming.<sup>10</sup>

Staff have examined the “de-listing” or de-regulation of methyl acetate and found that, even if usage increases as a substitute for non-exempt VOC that are ozone forming, it should not present any potential adverse air quality impacts. Typically, the odor of esters is not found to be unpleasant to most people compared to a variety of other solvents. Coatings often have esters already in the solvent mixture so it is not expected that new use or substitution of methyl acetate will result in the creation of objectionable odors.

There may be a potential for an increase in exposure to hazardous or toxic solvents if water soluble compounds are substituted for organic solvents in an effort to create low-VOC cleaning products. Typically, these concerns are based on the use of glycol ethers which are water soluble or miscible in water. Glycol ethers are a class of compounds, of which the most often used for cleaning formulations (including household cleaners) is propylene glycol monomethyl ether (PGME). It is also used in pesticides, paint remover and as a solvent for water based paints, dyes and stains. It has a sweet odor, low vapor pressure and, in addition to water, is soluble in acetone, which is VOC exempt. It is readily absorbed through the skin. The National Institute for Occupational Safety and Health (NIOSH) and American Council of Governmental Industrial Hygienists (ACGIH)

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<sup>9</sup> 63 Fed Reg 17331, US EPA, April 9, 1998

<sup>10</sup> Hazardous Substance Fact Sheet, New Jersey Dept. of Health and Senior Services, Dec., 1996

have set Threshold Limit Values (TLV's) and Recommended Exposure Limits (REL's) for this compound; however the Occupational Health and Safety Administration (OSHA) has not set a Permissible Exposure Limit, as it has for other glycol ethers. As such, PGME is considered less hazardous than other glycol ethers, which have more stringent TLV's and REL's<sup>11</sup>. The sort of industrial facilities that would be using low-VOC cleaners under this proposal have already been accustomed to dealing with potentially hazardous materials for which TLV's and REL's exist. These values are stated in terms of a concentration in a workroom atmosphere. Given the number of hazardous materials in existing coatings and solvents, and the very stringent TLV's and REL's associated with some compounds, such as diisocyanates, it is expected that facilities involved in surface coating or solvent cleaning are already well aware of ventilation standards and hazard protection procedures for workers. It is not expected that substitution of PGME in a low VOC aqueous solution for solvent would create a significant hazard exposure potential, especially since an aqueous cleaning solution would contain only approximately 5-7% by weight of any organic solvent.

An increased use of acetone creates the potential for a fire hazard. Acetone usage has increased as a result of a finding of negligible photochemical reactivity by the US EPA. Acetone is highly flammable, has a characteristic odor and has a high evaporation rate. The use of acetone as a cleaning solvent would be in compliance with the proposed standards for these rules, and is, in fact, already used in many facilities. However, the facilities that would begin using acetone for wipe cleaning because of these amendments would do so as a substitute for other solvents. Although acetone is highly flammable, the flammability rating given it by the fire safety code is the same as given typically to paint thinners or most other solvents. So the storage, use and disposal requirements are identical. Facilities already have safety precautions in place, such as the use of grounded electrical equipment and isolated separate storage lockers, and coating and chemical suppliers provide precautionary instructions for handling and storage.

Should aqueous cleaning solutions be disposed of in storm drain sewage systems, there is the potential for an adverse impact on water quality and wastewater systems. Some aqueous cleaners are advertised as "sewer safe", however solutions contaminated with oils, greases and metal fines cannot be disposed of in sewers. Facilities that are using solvents to prepare metal or plastic for painting are aware of wastewater discharge requirements. These facilities use paints and solvents and minimize hazardous waste by recycling or reclamation systems. The issue of the potential to create water quality impacts was extensively dealt with during and after the development of amendments to Regulation 8, Rule 16: Solvent Cleaning Operations in 1998. District staff developed an outreach program to affected sources in coordination with counties' environmental health departments to mitigate cross-media contamination. Regulations already exist that prohibit disposing of contaminated wastewater solutions, and affected facilities are

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<sup>11</sup> National Safety Council, <http://www.nsc.org/library/chemical/glycolet.htm>, 2002

already aware of these regulations. Consequently, deterioration of water quality and an increased need for public services related to wastewater processing are not anticipated.

These, and any other potential detrimental environmental effects of the proposed amendments will be examined and evaluated for significance in the environmental impact analysis that will accompany the final regulatory proposal.

### **REGULATORY IMPACTS ANALYSIS**

Section 40727.2 of the California Health and Safety Code requires an air district, in adopting, amending, or repealing an air district regulation, to identify existing federal and district air pollution control requirements for the equipment or source type affected by the proposed change in district rules. The district must then note any differences between these existing requirements and the requirements imposed by the proposed change. Where the district proposal does not impose a new standard, make an existing standard more stringent, or impose new or more stringent administrative requirements, the district may simply note this fact and avoid the analysis otherwise required by this law.

There are no federal standards for these types of surface preparation operations. The only District regulations to have an effect are standards associated with permits and with increases in emissions; Regulation 2: Permits, Rule 1: General Requirements and Rule 2: New Source Review. These rules provide the vehicle to limit the amount of emissions and of emissions increases, but do not in themselves directly set standards for the VOC content or types of solvents used. No other District regulations apply. Therefore, the analysis required by Section 40727.2 does not apply.

### **DISTRICT STAFF IMPACTS**

This proposal is not expected to result in any direct impacts on District staff. No additional staff will be required to inspect and enforce the additional requirements at existing permitted facilities. Inspection and enforcement procedures to determine compliance are consistent with existing practices and training. Because the amendments may affect some facilities that do not have permits, there will be additional permits to process and additional inspections to conduct. However, the applicability of permitting requirements is not proposed to be changed. This means that the facilities that may come into the system should be in the system currently. Public outreach efforts, including inspections, connected with the regulatory changes may discover some unpermitted facilities, as discussed above in "Emissions Subject to Control". However, it is expected that these facilities would eventually be discovered anyway and required to get permits. Should the outreach efforts encourage facilities to enter the District's permit system voluntarily, it may, in the long run, save some amount of District staff time because enforcement efforts will be minimized.

## CONCLUSION

The proposed amendments to Regulation 8, Rules 4, 14, 19, 31, and 43 are based on technology currently available and already employed by numerous facilities. The amendments will reduce volatile organic compound emissions by 2.19 tons per day and will satisfy control measure SS-13 in the 2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard. The proposed amendments are consistent with proposals in the Los Angeles area, in the San Joaquin Valley and the Sacramento area.

Pursuant to the California Health and Safety Code, Section 40727, regulatory amendments must meet findings of necessity, authority, clarity, consistency, non-duplication, and reference. The proposed amendments are:

- Necessary to limit emissions of Volatile Organic Compounds from surface preparation and clean up solvents, and necessary to meet the requirements of Control Measure SS-13 in the District's proposed 2001 San Francisco Bay Area Ozone Attainment Plan For The National 1- Hour Ozone Standard;
- Authorized by Sections 40000, 40001, 40702, 40725 through 40728 of the California Health and Safety Code;
- Clear, in that the rule is written or displayed so that it can be easily understood by the persons directly affected by it;
- Consistent with other District Rules and Regulations, and is not in conflict with, nor contradictory to state or federal law;
- Non-duplicative of other statutes, rules, or regulations;
- Implementing, interpreting, or making specific the provisions of California Health and Safety Code Sections 40001 (Adoption and Enforcement of Rules and Regulations) and 40702 (Adoption of Rules and Regulations).

The proposed amendments to these five District rules will be discussed at a public workshop on June 20, 2002. At that workshop, comments on potential environmental impacts will also be received and considered. A Draft Environmental Impact Report or Negative Declaration will be prepared and the public will be given a chance to comment on the environmental report in accordance with the provisions of the California Environmental Quality Act. Also, a socioeconomic impact analysis will be prepared in accordance with the provisions of the California Health and Safety Code, Section 40728.5. Staff anticipate a public hearing to consider adoption of the proposed amendments to Regulation 8, Rules 4, 14, 19, 31, and 43 in late summer or early fall, 2002.